

# Meade® 16" LX200GPS Schmidt-Cassegrain Telescope

**Professional instrumentation for the demanding school, college, or university research program—or as the ultimate personal telescope for the advanced amateur.**

With features generally offered only on custom-manufactured professional instruments, this largest of all Meade Schmidt-Cassegrains (in fact, the largest production Schmidt-Cassegrain in the world) fulfills the most demanding state-of-the-art requirements for the school, college, or university teaching or research program, or for the advanced amateur.

**Professional-grade optical system:** Continuing the tradition of Meade 8", 10", 12", and 14" SCT optics, the 16" LX200GPS yields the superlative imaging required in advanced applications, whether in planetary or deep-space

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*"...[with my 16" LX200] in just three weeks I have discovered two supernovae...The first was found on December 17, 2000, in the galaxy NGC 2526 at a magnitude of 18.8, with just a 90 second exposure [see p. 49]...I took 2,676 CCD images using a Meade f/6.3 focal reducer to make my first discovery...The second supernova is designated as 2001h and was discovered at magnitude 17.5 and rising. I took 1,332 CCD images to make my 2nd discovery. I want to tell you how pleased I am with the performance of the 16" LX200...I ran a 5.5 hour continuous scripting routine that secured 268 consecutive galaxies. The pointing accuracy was outstanding with every galaxy positioned within 4 arc minutes of the center of the 512 x 512 array. This is a totally out-of-the-box stock telescope...To search for supernovae requires a telescope that will take unguided images for at least 90 seconds, and the Meade 16" LX200 has research-quality optics and drive systems. [My] images are a testament to the telescope's smooth drive system....It's a pleasure working with a terrific instrument capable of performing real astronomical research."*

— Bob Holmes, Jr., Charleston, IL.

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visual or CCD imaging, in astrophotography, or in photometry. And, with its superclear BK7 optical glass correcting plate, the 16" LX200GPS may be used into the ultraviolet spectral region as well. Adding the Meade **Ultra-High Transmission Coatings** group (p. 26) increases the telescope's effective image-brightness aperture over the visible spectrum to more than 17".

**Oversize one-piece fork mounting:** The massive 16" LX200GPS fork system, cast in one continuous piece from one Declination housing to the other, includes a total of four 80mm roller bearings in Declination (two in each Declination housing) and two roller bearings in Right Ascension (one each 100mm and 150mm bearings in the RA housing). Such liberal usage of precision roller bearings into the telescope's design permits the addition of substantial auxiliary equipment without risk of strain on the mechanism and results in the most rigid tracking platform

available on a production telescope. Large DC-servo-motor-driven 11" worm gears on both telescope axes yield the smooth, precision tracking and slewing required of a professional instrument.

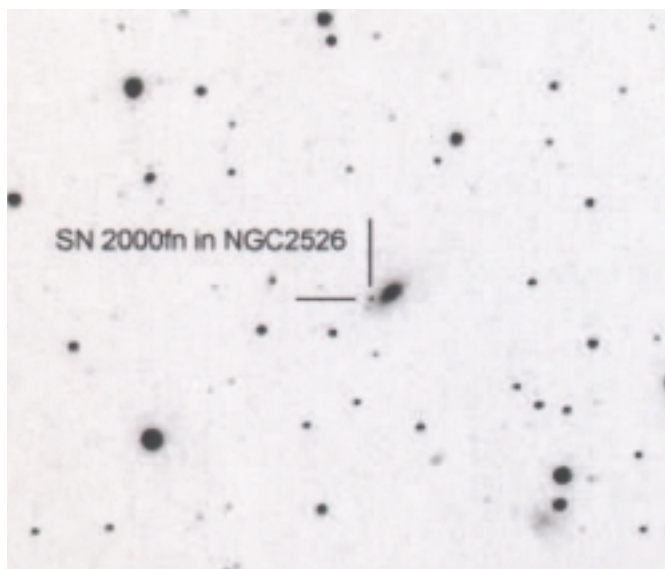
**Autostar II technology:** The purchaser of a Meade 16" LX200GPS is acquiring some of the most advanced technology ever built into a commercial telescope. Technology that includes all of the following features:

**Automatic GO TO capability** to any of 145,000 objects in the onboard database (see p. 33 for a comprehensive listing of this database), or to any RA and Dec. input to the Autostar II keypad, and with a typical pointing precision of better than 2 arc minutes in either the altazimuth or equatorial mode.

**A High-Precision Pointing mode** capable of pointing the telescope, automatically, to a precision of better than one arc-minute, if required.

Meade 16" LX200GPS Schmidt-Cassegrain telescope, with Supergiant Field Tripod.





**Discovery image by Bob Holmes, Jr. of Supernova 2000fn on December 17, 2000.** The supernova, at magnitude 18.8, lies in the 14th-magnitude galaxy NGC 2526 in Cancer. Mr. Holmes obtained this CCD image in a 90-sec. exposure with the Meade 16" LX200 Schmidt-Cassegrain. The faintest objects in this image are about 20th-magnitude.

**165 drive speeds on both axes**, pushbutton-actuated from the Autostar II controller: 0.01x to 1.0x sidereal, variable in 0.01x increments; 2x, 8x, 16x, 64x, 128x sidereal; 1°/sec. to 6°/sec., variable in 0.1° increments.

**Microprocessor-controlled sidereal-rate tracking** (or one of 2000 other incrementally-variable solar, lunar, or planetary rates) in either the altazimuth or equatorial mode, with typical tracking periodic error at an observatory-standard 5 arc seconds or less using the factory-programmed Smart Drive in both RA and Dec.

**A progressive-tension primary mirror lock** that effectively cancels any residual image shift while focusing during visual or imaging applications.

**The 16" LX200GPS**, shown with optional #1222 Field De-rotator (arrow), #62 T-Adapter, and a 35mm camera body attached to the standard-equipment Zero-Image Shift Microfocuser. The #1222 unit connects to a Field De-rotator port on the telescope's control panel. The optical tube's Thermal Stabilization Fan, provided as standard equipment, is visible at the "12 o'clock" position of the telescope's rear cell, with the primary mirror lock-knob located just below-right of the fan.



**Meade 16" LX200GPS with Permanent Altazimuth Pier.** As shown, the telescope fits comfortably inside a 2-meter (7 ft.) dome.

**The Meade 4-speed Zero Image-Shift Microfocuser** for precise focusing in sensitive lunar, planetary, or deep-space observing and simultaneously to maintain precise image centration in CCD imaging applications.

**Modern control-panel design**, with connectors for a wide range of optional accessories and features, including CCD autoguider, illuminated reticle eyepiece, field de-rotator, and optical tube thermal stabilization fan, as well as an RS-232 serial port connector.

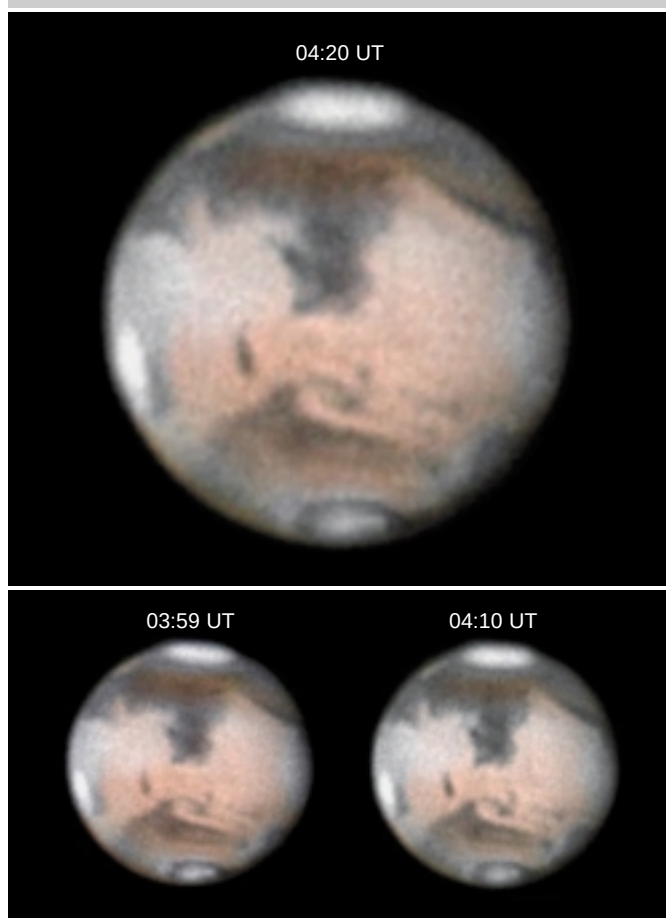
**Supergiant Field Tripod and Permanent Piers:** The 16" LX200GPS is offered with a choice of tripod or piers, each suitable to specific user applications:

**Supergiant Field Tripod:** Supplied with the Supergiant Field Tripod, the 16" LX200GPS is remarkably field-transportable for an instrument of its aperture and specifications. The telescope is manufactured in four basic modules (optical tube assembly with Declination housings attached; fork arm system; drive base; and field tripod) and, as such, is readily transported and set-up in the field by two adults in about 10 minutes. The extremely strong and rigid tripod assembly, incorporating 4"-diameter steel tripod legs, results in virtually no compromise whatever in telescope stability, as compared to the permanent pier systems described below.

Placed atop the Supergiant Field Tripod, the 16" LX200GPS operates in the altazimuth mode with the tracking and pointing accuracies previously described. For visual observing, or for CCD imaging or astrophotography not exceeding four to five minutes' duration, no additional equipment is required. During longer periods of imaging or photography, however, field rotation, an effect inherent to any altazimuth-mounted telescope, becomes apparent. The result of such field rotation during photography or imaging is to cause stars at the outer edge of the field to appear to rotate relative to the centrally-located star, even if the exposure is perfectly guided. This effect can be cancelled completely and precisely by adding the optional Meade #1222 Field De-rotater (*below*).

**Permanent Altazimuth Pier:** For observatory applications the 16" LX200GPS may be ordered with the Permanent Altazimuth Pier, a mounting system that results in comfortable, readily-accessible eyepiece positions at all

**The planet Mars, March 29, 1997**, imaged by Dr. Donald Parker using a Meade 16" LX200 telescope and Pictor 416XT imager. In these images south is up. The north polar cap is visible below the Utopia region with Syrtis Major, perhaps the most prominent Martian surface feature, just south of the equator. The large white area near Mars' south pole is the Hellas asteroid impact basin. Dr. Parker writes, "The Meade 16" LX200 delivers extraordinary images and is a pleasure to use. It is rare for a commercial telescope of this aperture to show stellar images with such well-defined Airy discs and diffraction rings. The optical requirements for my imaging work are extremely high, and the 16" LX200 has fully met these requirements."



telescope pointing locations and is ideal in those environments where the instrument must be housed in a minimum of space.

**Permanent Equatorial Pier:** If auxiliary astro cameras or other long-exposure imaging devices are to be piggybacked to the telescope, then the telescope should be specified with the Permanent Equatorial Pier. Thus mounted in the equatorial mode, there is no field rotation in either the main telescope or in any auxiliary, piggybacked instruments. All Permanent Equatorial Piers are custom-manufactured to match the latitude of the specified observing site.

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*"...New Milford [CT] High School is a bustling community of 1500 students and educators — and home to one of the finest astronomical facilities on any public-school campus...The observatory's principal telescope is a Meade 16-inch LX200 Schmidt-Cassegrain permanently mounted on a rock-solid concrete pier...[The observatory was] built by volunteers from the Western Connecticut Chapter of the Society for Amateur Scientists (WCCSAS)...Of all the achievements to date, [WCCSAS president Monty] Robson is cheered most by the one that occurred on March 14, 2001, when the International Astronomical Union (IAU) assigned code number 932 to the observatory. Only facilities that produce astronomical measurements of the highest quality are eligible to receive observatory codes. [The observatory] earned number 932 after WCCSAS member [Jeff] Miskie submitted precise positions of the Earth-approaching asteroid 1620 Geographos to the IAU's Minor Planet Center in late February. 'The images were taken through the [Meade 16" LX200] with a CCD camera,' explains Robson, 'and with the school's parking-lot lights on, a bright Moon in the eastern sky, and snow covering the ground.' " — from *Sky & Telescope*, July, 2001.*

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**Home Pulse Acquisition:** Included as standard equipment with all 16" LX200GPS models, and unique among commercial telescopes, is a special "home pulse" feature that allows the telescope's operating system to maintain the telescope's pointing position in non-volatile memory, even when the telescope is turned off. The advantage of such a system is that the telescope may be remotely aligned and operated over an arbitrarily long distance, through a modem link to the telescope's RS-232 serial interface. In this way Meade 16" LX200GPS telescopes may be operated through a pre-programmed sequence of, for example, CCD imaging, without a human operator being present in the observatory.

**Optional Field De-rotater:** For use with the 16" LX200GPS in the altazimuth mode (whether by the Supergiant Field Tripod or Permanent Altazimuth Pier), the Meade #1222 Field De-rotater (*see photo, p. 49*) attaches to the rear cell of the telescope and plugs into a special connector on the control panel. Digital data fed from the telescope's microprocessor to the Field De-rotater permit precise and continuous update of the de-rotation required to maintain pinpoint star images throughout the field. (*See photos, p. 52.*) The effect is that even during the longest CCD or photographic exposures, the telescope acts as if it were precisely equatorially mounted.

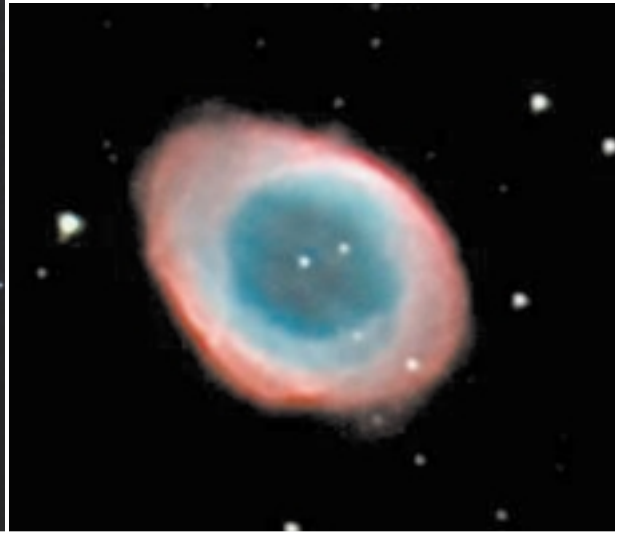
"Our Meade 16" LX200 Schmidt-Cassegrain is permanently mounted in its own observatory dome near the historic 60" reflector here at Mt. Wilson. The telescope has proven to be the real workhorse of both our public outreach program and other special programs sanctioned by the Observatory. Each year during the summer and fall months the general public is allowed access to the 16" LX200 at regularly scheduled star parties. Images of both solar system and deep sky objects are incredible, with planetary images being particularly stunning because of a combination of exceptional seeing conditions common to the mountain and the fine optics of the telescope. Annually, undergraduate physics and astronomy students and advanced amateurs from around the world gather at Mt. Wilson for two weeks during the summer to attend the Consortium for Undergraduate Research and Education in Astronomy (CUREA) program. Utilizing the 16" LX200 nightly to conduct varied scientific projects that include imaging, photometry, and spectroscopy, the excellent optics of the telescope contribute to making this program feasible and provide a deeply rewarding experience for all the participants." — David M. Jurasevich, 16" LX200 Program Director, Mt. Wilson Observatory Association, Mt. Wilson, Calif.

CCD (LRGB) Images by David M. Jurasevich with the Meade 16" LX200 at Mt. Wilson Observatory, Mt. Wilson, Calif. (clockwise from upper right) The Horsehead Nebula (IC 434) in Orion, a 90-min. exposure, L only; **Spiral Galaxy (M81) in Ursa Major**, 120-mins. L, plus 20-mins. each R and G, 32-mins. B; **Globular Cluster (M15) in Pegasus**, 10-mins. each LRG, 18-mins. B; the **Whirlpool Galaxy (M51) in Canes Venatici**, 80-mins. L, 15-mins. each R and G, 24-mins. B.

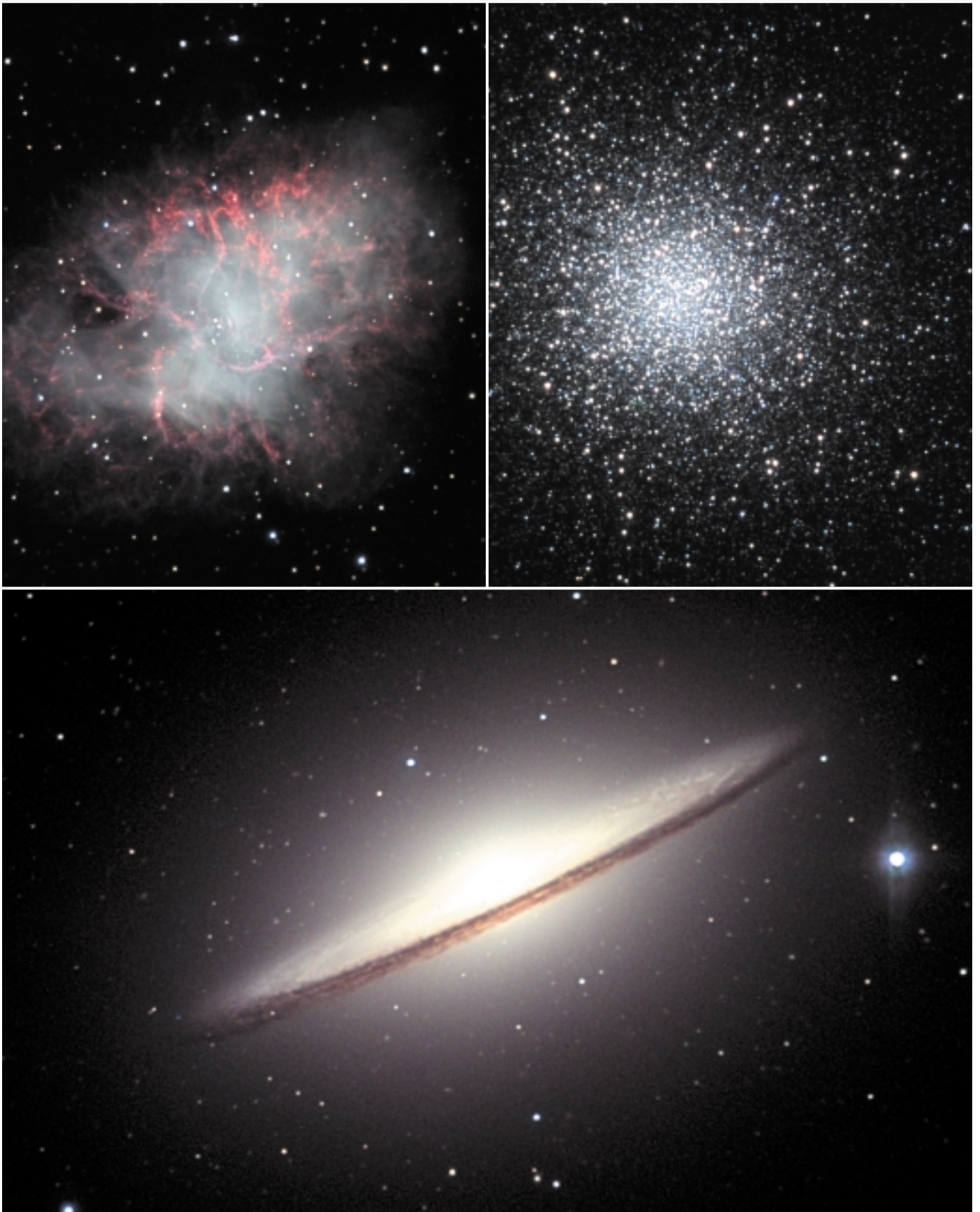




**16" LX200 Schmidt-Cassegrain Astrophotos** (*clockwise from left*): **The Whirlpool Galaxy (M51) in Canes Venatici**, as photographed by Jason Ware with his 16" LX200 mounted on the altazimuth field tripod (*p. 48*). Mr. Ware scanned, digitally combined, and processed two one-hour photos on gas-hypered Fuji Super G800 film to obtain the result here. During this time the telescope's altazimuth field rotated 21°, a rotation fully and precisely compensated for by the Meade #1222 Field De-rotater (*p. 49*). **The Ring Nebula (M57) in Lyra**; a combination of thirteen 2-minute CCD exposures by Marko Moilanen and Arto Oksanen. The central star is 15th-magnitude. **The Swan Nebula (M17)**, photographed by Mr. Ware; two one-hour emulsions on Kodak PPF 400 film were scanned, digitally combined, and processed to yield this stunning image, one of the most detailed ever obtained of M17.



CCD images with the Meade 16" LX200 Schmidt-Cassegrain (clockwise from upper left): The Crab Nebula (M1) in Taurus; Globular Star Cluster (M13) in Hercules; the Sombrero Galaxy (M104) in Virgo. Images supplied by Adam Block of the Advanced Observing Program, National Optical Astronomy Observatory/Kitt Peak National Observatory, Ariz.



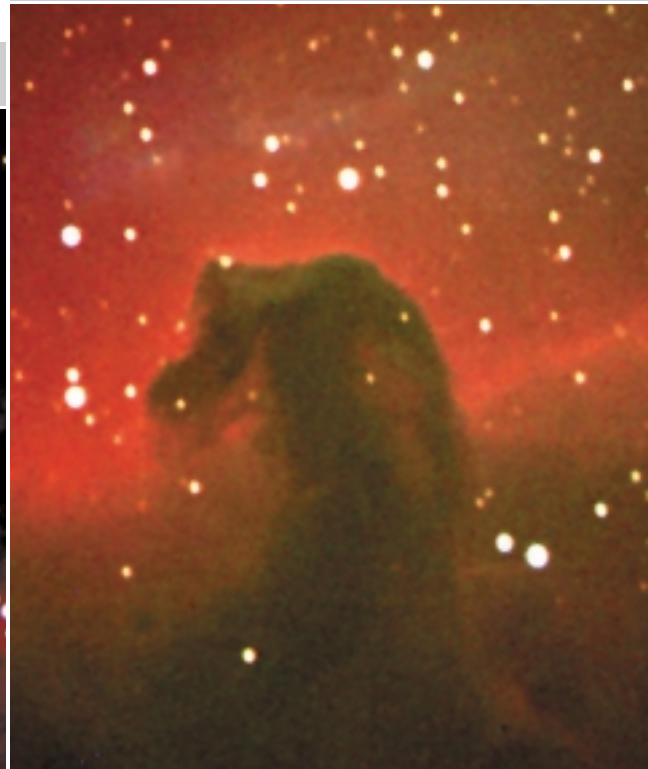
## Jack Newton: pushing back the frontiers.

Over the past thirty years Jack Newton, of Portal, Arizona, has continually extended the reach of, first, amateur astrophotography, and, later, CCD imaging. Universally regarded as one of the world's foremost deep-space CCD imaging specialists, Mr. Newton has used CCD imagers with his Meade 16" LX200 Schmidt-Cassegrain to obtain some of the most exquisite digital images ever produced with any instrumentation, amateur or professional. Mr. Newton's images have been published in numerous astronomical magazines and journals worldwide, and he is widely sought after as a source of information and counsel by those of his fellow amateurs seeking to explore the outer limits of their instruments' imaging capabilities. A small portion of Mr. Newton's voluminous and precedent-setting work with the 16" LX200 is presented on these pages.

**The Eagle Nebula (M17) in Serpens Cauda.** CCD image with a Meade 16" LX200 at f/10. Exposures: 6-mins. light; 4-mins. red; 8-mins. each green and blue.



(above) **The Veil Nebula in Cygnus.** Meade Pictor 1616XT CCD image; Meade 16" LX200 Schmidt-Cassegrain telescope. Exposures: 5-mins. red; 20-mins. each green and blue.



(above) A Pictor 1616XT CCD image of the **Horsehead Nebula (IC434) in Orion**; 16" LX200.

(below) A CCD image of the 9th-magnitude **Blackeye Galaxy (M64)**; 16" LX200.





**The Pinwheel Galaxy (M101, NGC 5457);** a CCD image by Mr. Newton with the Meade 16" LX200 Schmidt-Cassegrain.

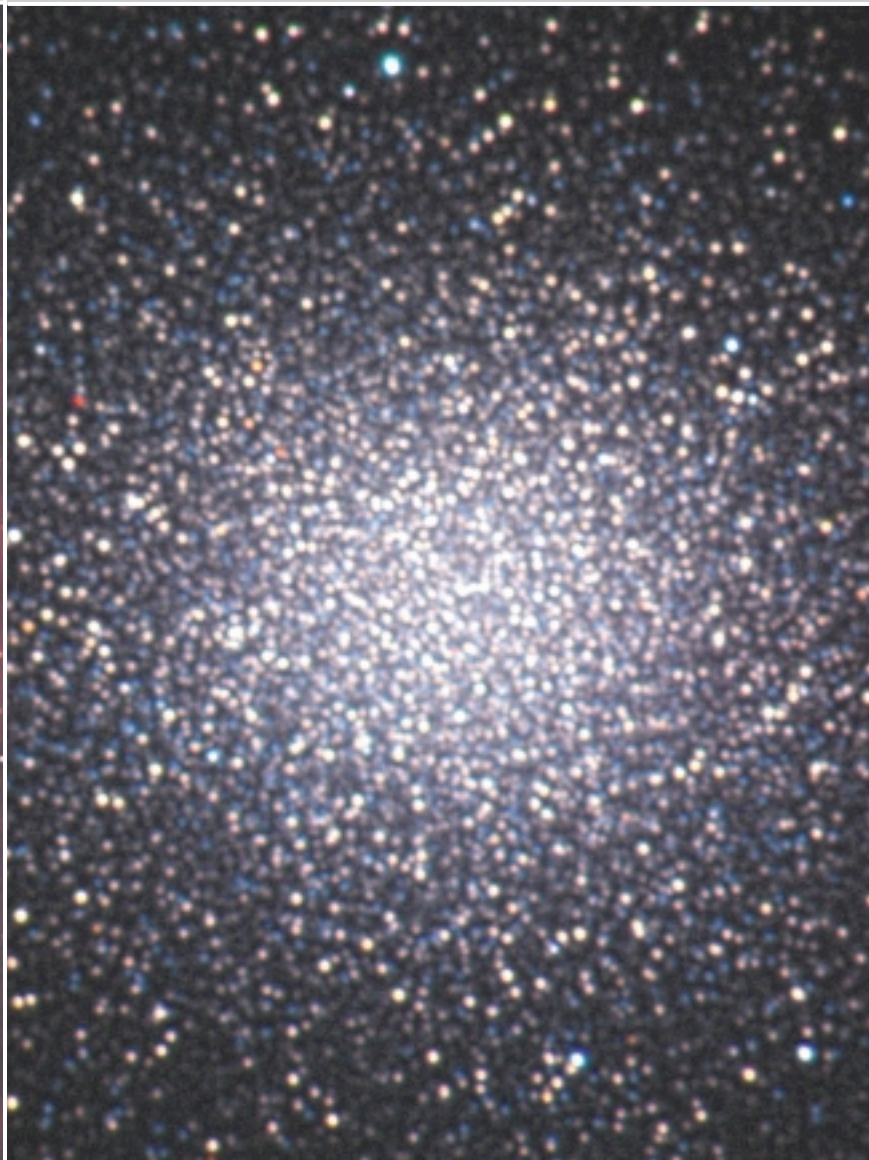


**The Dumbbell Nebula (M27) in Vulpecula.** Pictor 1616XTE with 16" LX200 Schmidt-Cassegrain.

**CCD image of Diffuse Nebula IC 1795 in Cassiopeia** with Meade 16" LX200. Exposures: 8-mins. light; 4-mins. red; 12-mins. each green and blue.



**Globular Cluster Omega Centauri (NGC 5139).** A CCD image taken with the Meade 16" LX200 Schmidt-Cassegrain telescope.



**Using the Meade 16" LX200GPS:** Meade 16" Schmidt-Cassegrain telescopes have been shipped worldwide to advanced amateurs, schools, and university observatories, where they are regularly used in programs of serious

*"One year ago we installed a Meade 16" LX200 Schmidt-Cassegrain to serve as the primary instrument for our public observing programs here at McDonald Observatory. The telescope's professional capabilities such as the GO TO positioning function and computer interface demonstrate the excitement of research astronomy to the public. This has greatly diversified our public programs and allowed us to observe hundreds of deep-sky objects quickly for thousands of fascinated users. Housed in its own permanent observatory and sharing Mt. Locke with world-class research telescopes, the 16" LX200 is a fine instrument we are extremely pleased to have acquired."* — **Marc Wetzell, University of Texas - McDonald Observatory, Mt. Locke, TX.**

astronomical research — research that ranges from remote imaging and photometry of variable stars to supernova patrols, asteroid cataloging, and planetary studies. Shown on these pages are images that attest to the remarkable level of planetary and deep-space resolution obtainable



**Specifications: 16" Model LX200GPS**—Includes 16" Schmidt-Cassegrain optical tube assembly (D = 406mm, F = 4064mm, f/10) with MgF<sub>2</sub> coatings on the correcting lens and standard aluminum coatings on the primary and secondary mirrors (Ultra-High Transmission Coatings, p. 26, available optionally); primary mirror lock; 4-speed Zero Image-Shift Microfocuser; heavy-duty, one-piece fork mount with 6 roller bearings and dual-axis 11" worm gears; 7-port multi-function control panel, including RS-232 serial interface and field de-rotator ports; manual and electric slow-motion controls on both axes; thermal stabilization fan; setting circles in RA and Dec; Autostar II control system with 3.5-Megabyte flash memory, digital readout display, factory-programmed Smart Drive and 165-speed drive controls on both axes, High-Precision Pointing, and 145,000-object onboard celestial software library; GPS alignment system with 16-channel GPS receiver, magnetic declination compensation, and true-level and North electronic sensors; home-pulse software for remote telescope operation; 25 ft. power cord and adapter for telescope operation from 115v AC (for field operation from 12v DC auto cigarette lighter plug, see optional #1812A Electronic DC Adapter, p. 63); 8 x 50mm viewfinder; 2" diagonal mirror with 1.25" adapter; Series 4000 Super Plössl 26mm eyepiece (156x); operating instructions; shipped in foam-fitted export-quality cartons. Choice of tripod or piers available at slightly varying prices: supergiant transportable field tripod; permanent altazimuth pier; or permanent equatorial pier. In case of permanent equatorial pier, specify observatory latitude within 0.5°.

**Specifications and Features: 16" LX200GPS**

|                                             |                                                                                                                                                                                                                                |
|---------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Optical Design                              | Schmidt-Cassegrain                                                                                                                                                                                                             |
| Clear Aperture                              | 406.4mm (16")                                                                                                                                                                                                                  |
| Primary Mirror Diameter                     | 415.9mm (16.375")                                                                                                                                                                                                              |
| Focal Length; Focal Ratio                   | 4064mm; f/10                                                                                                                                                                                                                   |
| Near Focus (approx.)                        | 100 ft.                                                                                                                                                                                                                        |
| Resolving Power (arc secs.)                 | 0.28                                                                                                                                                                                                                           |
| Optical Coatings                            | MgF <sub>2</sub> on correcting plate (2-sides); standard aluminum on primary & secondary mirrors                                                                                                                               |
| Ultra-High Transmission Coatings (p. 26)    | optional at time of purchase                                                                                                                                                                                                   |
| Limiting Visual Magnitude (approx.)         | 16.0                                                                                                                                                                                                                           |
| Limiting Photographic Magnitude (approx.)   | 20.0                                                                                                                                                                                                                           |
| Image Scale (degs./inch)                    | 0.36                                                                                                                                                                                                                           |
| Maximum Practical Visual Power              | 800X                                                                                                                                                                                                                           |
| 35mm Angular Film Coverage                  | 0.34° x 0.49°                                                                                                                                                                                                                  |
| Optical Tube Dimensions                     | 17.5" dia. x 33" long                                                                                                                                                                                                          |
| Secondary Mirror Obstruction                | 5.0" dia.; 9.8%                                                                                                                                                                                                                |
| Telescope Mounting                          | one-piece fork, double-time                                                                                                                                                                                                    |
| Setting Circle Diameters                    | Dec.: 12"; RA: 17"; both with verniers                                                                                                                                                                                         |
| RA and Declination Control Systems          | both axes: 165-speed, microprocessor-controlled 18v DC servo motor; 11" LX worm gear with Smart Drive software                                                                                                                 |
| Primary Mirror Lock                         | included (progressive tension)                                                                                                                                                                                                 |
| Zero Image-Shift Microfocuser               | included (4-speed)                                                                                                                                                                                                             |
| GPS Alignment                               | included (16-channel GPS receiver, electronic sensors for true-level and North, with magnetic declination compensation)                                                                                                        |
| GO TO Pointing Precision (approx.)          | 2-arc mins. (1-arc min. in HP-mode)                                                                                                                                                                                            |
| Slew Speeds, RA and Dec.                    | 0.01x to 1.0x sidereal, variable in 0.01x increments; 2x, 8x, 16x, 64x, 128x sidereal; 1"/sec. to 6"/sec., variable in 0.1° increments                                                                                         |
| Tracking Rates                              | sidereal, lunar, or custom-selected from 2000 incremental rates                                                                                                                                                                |
| Hemispheres of Operation                    | North and South, selected by GPS or user                                                                                                                                                                                       |
| Maximum Current Draw at dual-axis fast-slew | 2.0 amperes                                                                                                                                                                                                                    |
| Slow-Motion Controls                        | electric, RA and Dec.                                                                                                                                                                                                          |
| Bearings                                    | Dec.: 2 x 80mm roller bearings in Declination assembly of each fork arm; RA: 1 x 100mm and 1 x 150mm roller bearings.                                                                                                          |
| Autostar II Hand Controller                 | Atmel 89C451 & PIC16C57 microcontrollers; 2 line x 16 alphanumeric character display; 20-button keypad, red LED backlit                                                                                                        |
| Main Telescope Controller                   | distributed intelligence architecture using 8 networked microcontrollers (Motorola 68HC11, Atmel 89C451, 3 x PIC16C62, 2 x PIC16C54, Sony digital signal processor); 3.5-Megabyte flash memory (field reprogrammable), 32K RAM |
| Onboard Celestial Object Database           | 147,541 objects                                                                                                                                                                                                                |
| #1222 Field De-rotator                      | optional                                                                                                                                                                                                                       |
| Materials: Tube Body and Mount Castings     | aluminum                                                                                                                                                                                                                       |
| Primary and Secondary Mirrors               | Pyrex® glass, Grade-A, fine-annealed                                                                                                                                                                                           |
| Correcting Plate                            | BK7 optical glass                                                                                                                                                                                                              |
| Piers and Tripods: Supergiant Field Tripod  | height: 32"; leg diameter: 4", with 4"-long inner leveling legs; materials: aluminum castings with chromed steel legs; net weight: 88 lbs.                                                                                     |
| Permanent Altazimuth Pier                   | height: 32"; diameter: 10"; material: steel; net pier weight: 225 lbs.                                                                                                                                                         |
| Permanent Equatorial Pier                   | height: 42" (approx.); diameter: 10"; material: steel; net pier weight: 240 lbs.                                                                                                                                               |
| Telescope Dimensions, swung down            | 18" x 32" x 51"                                                                                                                                                                                                                |
| Total Net Telescope Weight                  | 318 lbs. (with Field Tripod)                                                                                                                                                                                                   |
| Heaviest Sub-Section for Field Assembly     | 125 lbs. (optical tube assembly)                                                                                                                                                                                               |
| Total Shipping Weight (approx.)             | 360 lbs.                                                                                                                                                                                                                       |



**Meade 16" LX200GPS Schmidt-Cassegrain telescope** on permanent equatorial pier for observatory installation. *Background:* CCD image of the Omega Centauri globular cluster (NGC 5139) by Tim Puckett and Alex Richter with the 16" LX200. Imaged at Johannesburg, South Africa; exposure time: one minute.